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PATENT APPLICATION
Mo-6323
STA-151

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN APPLICATION OF	
	Group 1742
GERHARD GILLE ET AL	
SERIAL NO.: 09/831,567	
FILED: MAY 10, 2001	EXAMINER: H. WILKINS III
TITLE: METHOD FOR PRODUCING WOLFRAM CARBIDES BY GAS-PHASE CARBURETION	

APPEAL BRIEF

Commissioner for Patents
Alexandria, VA 22313
Sir:

This Brief, submitted in triplicate, is an appeal from the Final Office Action dated January 31, 2003, in which Claims 10-15 were finally rejected. The Brief also addresses the issues raised in the Advisory Action mailed July 9, 2003. A Notice of Appeal was filed on July 29, 2003. A separate Petition of Time is being filed simultaneously herewith.

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents Alexandria, VA 22313, on December 29, 2003
Date

Diderico van Eyl Reg. No. 38,641
Name of Appellant, assignee or Registered Representative

Signature

December 29, 2003
Date

I. REAL PARTY IN INTEREST

The real party in interest is assignee H.C. Starck GmbH.

II. RELATED APPEALS AND INTERFERENCES

Appellants are unaware of any related appeals or interferences which directly or indirectly affect the present appeal.

III. STATUS OF CLAIMS

Claims 10-15 stand rejected.

IV. STATUS OF AMENDMENTS

Claims 10-15 stand as presented in n Amendment filed on September 26, 2002.

V. SUMMARY OF THE INVENTION

VI. ISSUES

The issues before the Board are as follows:

1. Are Claims 10-15 obvious under 35 USC 103 over by XP-000874467?
2. Is Claim 15 obvious under 35 USC 103 over XP-000874467 in view of FR 2 294 133?

VII. GROUPING OF CLAIMS

Claims 10-15 stand together as a single group.

VIII. ARGUMENTS

Rejections Under 35 USC 103

The Examiner rejected Claims 10-14 on the grounds that they were clearly obviated by XP-000874467 (Alonso). The rejection should be withdrawn in view of the remarks below.

The rejection should be withdrawn. It is well settled that to establish a *prima facie* case of obviousness, the USPTO must satisfy all of the following requirements. First, the prior art relied upon, coupled with the knowledge generally available in the art at the time of the invention, must contain some suggestion or incentive that would have motivated the skilled artisan to modify a reference or to combine references. *In re Fine*, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). Second, the proposed modification

must have had a reasonable expectation of success, as determined from the vantage point of one of ordinary skill in the art at the time the invention was made. *Amgen v. Chugai Pharmaceutical Co.* 18 USPQ 2d 1016, 1023 (Fed Cir, 1991), *cert. denied* 502 U.S. 856 (1991). Third, the prior art reference or combination of references must teach or suggest all of the limitations of the claims. *In re Wilson*, 165 USPQ 494, 496, (CCPA 1970). The Examiner did not establish a *prima facie* case of obviousness.

Appellants' invention relates to a process that makes a tungsten carbide. The process involves gas phase carburization of tungsten powders and/or suitable tungsten precursor compound powders at a temperature ranging from 850°C to 950°C, such that the carburizing gas phase used is a CO_2/CO mixture. The CO_2 content is above the Boudouard equilibrium content corresponding to the carburization temperature. The carburization is carried out with a carbon activity ranging from 0.4 to less than 1. In one embodiment, the carburization is carried out with a carbon activity from 0.4 to 0.9. In another embodiment, the carburization temperature ranges from 900°C to 950°C. In another embodiment, the carburization is carried out at carburization temperature over a period from 4 to 10 hours.

Alonso teaches the production of tungsten carbide (WC) from tungsten trioxide (WO_3) by means of CO-CO_2 mixtures (61, 78 and 100% v/v CO) in the temperature interval ranging from 700°C to 1100°C (See Abstract). Alonso teaches that between 700 and 800°C, the process was controlled by the nucleation and growth of the lower oxide $W_{20}O_{58}$, whereas between 800 and 1100°C the process was controlled by the elementary reaction $WO_2 \rightarrow W$. Alonso teaches that a second order dependence of the initial rate constant with respect to partial CO pressure was estimated. The thermomechanical data used for the W-C-O system were consistent with the experimental results. Alonso concluded that the most appropriate conditions for the reduction-carburization of tungsten trioxide by means of carbon monoxide-carbon dioxide mixtures were a temperature of 900°C, a gaseous mixture composition of 100% v/v CO, a volumetric flow rate of 1450 ml (STP)/min and a time of 6 hours. Under these conditions, according to Alonso, a tungsten carbide powder with an average particle diameter of 0.40 μm was obtained.

Alonso does not suggest Appellants' invention. An object of Appellants'

invention is to provide a process for the carburization of tungsten powders or tungsten precursor powders, which allows fast and complete carburization **and** also ensures that deposition of free carbon on the produced tungsten carbide is avoided (See Specification, page 2, lines 21-29). Alonso is completely silent about this object and recommends using CO solely, i.e. to avoid mixtures of CO and CO_2-a process inevitably resulting in carbon deposition. Withdrawal of the rejection is requested.

Alonso teaches gas-phase carburization of tungsten trioxide using CO without any CO_2 as well as using CO_2/CO mixtures containing 78 and 61 % by volume of CO, respectively. At a temperature of 900°C the corresponding carbon activities are 0.026 (61 % CO), 0.077 (78 % CO) and essentially infinity (100 % CO), respectively. Appellants have found that such alternatives are disadvantageous. Low carbon activity results in a low reaction rate, whereas a carbon activity being essentially infinity results in deposition of free carbon on the produced tungsten carbide. Withdrawal of the rejection is requested.

Alonso does not teach other contents of CO. Alonso does not teach other carbon activities. This means Alonso teaches either using a mixture of CO and CO_2 having a very low carbon activity, or completely avoiding CO_2 (carbon activity = essentially infinity). Alonso does teach these two alternatives and does not teach a broad range for the carbon activity as alleged by the Examiner. Withdrawal of the rejection is requested.

B. Rejection of Claim 15 Under 35 USC 103 over Alonso in view of FR 2 294 133

The Examiner rejected Claim 15 under 35 USC 103 over Alonso in view of FR 2 294 133 (FR '133).

Appellants' invention, as encompassed by Claim 15, relates to a process that subjects the tungsten carbide made by the process according to Claim 10 to a heat treatment at a temperature ranging from 1,150°C to 1,800°C after carburization.

FR '133 teaches obtaining WC by treating finely divided WO_3 with CO at a temperature at which no agglomeration or sintering action takes place to effect the following reaction $WO_3 + 5CO \rightarrow WC + 4\ CO_2$.

The rejection should be withdrawn. It is known by one skilled in the art that the specific surface area of powders made by thermal decomposition depends on the

decomposition temperature. Increasing decomposition temperature results in decreasing specific surface area, Le. increasing particle size. To support this point, Appellants hereby enclose a copy of the publication entitled "Chemistry of Powder Production," (p. 106-113), which teaches this phenomenon for MgO (Figure 4.15) and BaTiO3 (See Figure 4.18).

Accordingly, one of ordinary skill in the art would have expected that heat treatment of WC at temperatures higher than the temperature of carburization would result in an increase of particle size of the WC-powder. In case such a powder is used to produce a liquid-phase sintered composite material, e.g., WC-Co (= hard-metal) the degree of dispersion of the WC-phase and hence the hardness of the composite material was supposed to decrease. Surprisingly, Appellants have discovered that is not the case. Instead, Appellants have discovered that the hardness increase (See Table 2, Example 1 (no heat treatment) vs. examples 2, 3 and 5 (heat treatment)) is observed.

CONCLUSION

The differences between Appellants invention and Alonso, singly or in combination with FR'133, compel the withdrawal of the rejections under 35 U.S.C. 103. Alonso does not teach heat treatment after carburization. The same is true with regard to FR'133. FR'133 teaches that the reaction of WO_3 and C proceeds at a temperature ranging from1200 to1500°C, but this is the carburization temperature and not at all a temperature range regarding heat treatment of WC after carburization. Surprisingly, heat treatment according to the invention encompassed by Claim 15 results in material with decreased tendency to secondary grain growth (e.g., to a material with a very homogeneous structure (See page 12, lines 9-11 and Fig. 5 and 6)). One of ordinary skill in the art following the teachings of Alonso, singly or in combination with FR '133 would not have been motivated to modify Alonso, practice Appellants' invention, and expect the results Appellants' have obtained.

In view of the foregoing amendments and remarks, withdrawal of the rejection of the pending claims is earnestly requested.

Respectfully submitted,

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APPENDIX: CLAIMS ON APPEAL

1-9 (Cancelled)

10. (Previously Presented) A process for preparing a tungsten carbide comprising gas phase carburization of tungsten powders and/or suitable tungsten precursor compound powders at a temperature ranging from 850°C to 950°C, wherein the carburizing gas phase used is a CO_2/CO mixture with a CO_2 content which is above the Boudouard equilibrium content corresponding to the carburization temperature, and wherein the carburization is carried out with a carbon activity ranging from 0.4 to less than 1, thereby forming the tungsten carbide.

11. (Previously Presented) The process according to Claim 10, wherein carburization is carried out with a carbon activity ranging from 0.4 to 0.9.

12. (Previously Presented) The process according to Claim 10, wherein the carburization temperature ranges from 900°C to 950°C.

13. (Previously Presented) The process according to Claim 10, wherein the carburization is carried out at the carburization temperature over a period ranging from 4 to 10 hours.

14. (Previously Presented) The process according to Claim 10, wherein the precursor compound is tungsten oxide powder.

15. (Previously Presented) The process according to Claim 10, wherein the process further comprises subjecting the tungsten carbide made by the process according Claim 10 to a heat treatment at a temperature ranging from 1,150°C to 1,800°C after carburization.